

# PATENT SPECIFICATION (11) 1 404 757

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## (54) GAS TURBINE ENGINE BLADES

(71) We, ROLLS-ROYCE (1971) LIMITED of Norfolk House, St. James's Square, London, SW1Y 4JS, a British Company, do hereby declare the invention for which we  
 5 pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the blades for gas  
 10 turbine engines.

It is an object of the present invention to provide a rotor or stator blade construction which enables improved cooling to be obtained.

15 According to the invention there is provided a gas turbine blade comprising a cooling medium passage leading from an inlet at one radial end of the blade obliquely towards the other end and the region of the leading edge  
 20 of the blade and thence obliquely toward said other end and the region of the trailing edge of the blade, and an outlet in the latter region between the passage and the exterior of the blade.

25 In a preferred form, the invention is applied to rotor blades having said inlet at the root end of the blade.

The invention will now be described with reference to the accompanying drawing  
 30 wherein:—

Figure 1 shows a sectional elevation of a gas turbine rotor blade according to the invention, the section being taken on the line B-B in Figure 2;

35 Figure 2 shows a section on the line A-A in Figure 1, to a scale ten times that of Figure 1; and

40 Figure 3 shows an isometric view of the shroud end of the rotor blade, seen looking from the root towards the shroud.

The rotor blade in Figure 1 comprises a body of aerofoil shape having opposite sides extending between leading and trailing edges 10, 11, a shroud end 12 and a root end 13. The body is hollow, the sides being defined by opposite walls, 17, 18 and the space within it is effectively divided into two by means of a sheet-metal insert 14 which extends sub-

stantially the full radial length of the blade, being brazed to the body at its root end but otherwise unattached to allow for differential expansion. The arrangement of the insert 14 within the blade is clearly seen in Figure 2.

It will be seen that the insert is located between a large number of pimples 15 (indicated in Figure 1 by small crosses) and by a series of helical fins 16. The blade is conveniently made with the pimples and fins cast integrally with the interior surfaces of the walls 17, 18. The insert 14 stops short of both the leading and trailing edges of the body, thus leaving spaces around which air may pass in order to progress from one side of the insert to the other.

Referring now again to Figure 1, it will be seen that air supplied to the interior of the blade from the root end 13 can enter any one of a series of flow passages extending obliquely to the radial length of the blade up one side of the insert passing round the leading or trailing edge of the insert, and then continuing obliquely up the other side of the insert. An arrow traces one possible path. As it progresses radially outwards, a proportion of the air is allowed to escape through leading edge film cooling holes 20, and through trailing edge slots 21. Since the volume of air flowing through the blade is thus diminished, the flow passages are designed to be of smaller cross section towards the outer shroud end 12 of the body. This can be achieved by arranging that the spacing of the fins 16 is reduced or, more conveniently, by reducing the width of the passages. This maintains the airflow velocity substantially constant. In addition, the velocity of the air flow may be varied by altering the angle at which the fins 16 are disposed.

In a preferred form of the invention, holes 22 (Figure 3) may be provided for the final escape of the cooling air in the angle formed by the wall 17 and a shroud 23 to which the blades are connected. The air thus released can be used to cool the shroud by causing it to spread over the shroud 23 along channels

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24 formed in the radially inner surface thereof.

It will be seen that a blade constructed in the fashioned described is relatively easy to produce, particularly since the insert is solid and therefore easy both to manufacture and to insert into the body while the body itself can be conveniently cast, together with fins and pimples, using only a single piece core.

10 If desired, in the described arrangement the holes 20 and/or the pimples 15 may be omitted, the cooling medium may be liquid or a gas other than air, and the fins 16 and pimples (if provided) may be other than integral with the walls.

15 It will be seen that the flow passages extend between an air inlet at the root end 13 and respective outlets or slots 21.

WHAT WE CLAIM IS:—

20 1. A gas turbine blade comprising a cooling medium passage leading from an inlet at one radial end of the blade obliquely towards the other end and the region of the leading edge of the blade and thence obliquely 50 toward said other end and the region of the trailing edge of the blade, and an outlet in the latter region between the passage and the exterior of the blade.

25 2. A gas turbine blade according to claim 1 wherein the passage extends from the

trailing edge region to an outlet provided at said other end of the blade.

3. A blade according to claims 1 or 2 comprising an outlet between the passage and the exterior of the blade in the region of said leading edge. 35

4. A blade according to claim 2 comprising a shroud connected to said other end of the blade and wherein the outlet provided at said other end is situated for flow therefrom 40 to pass into cooling relationship with the shroud.

5. A blade according to claim 4 wherein said outlet is situated at the junction between the blade and the radially inner surface of the 45 shroud.

6. A blade according to any one of the preceding claims wherein the blade comprises a hollow body having walls provided with fins extending obliquely along and around the interior thereof, and an insert in the interior of the body, the passage being bounded by the sides of the insert, the walls and a pair of said fins. 50

7. A gas turbine blade substantially as 55 described herein with reference to the accompanying drawing.

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